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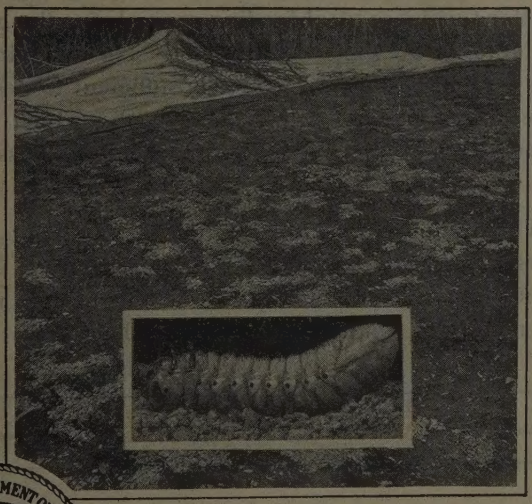
The GREEN JUNE BEETLE LARVA

IN TOBACCO PLANT BEDS



THE scarcity of wood and the limited areas of new ground or virgin soil for tobacco plant beds have brought about some radical changes in their management and treatment. Permanent location of the plant beds is replacing the practice of preparing them in new places year after year, and steaming is replacing the burning of the beds with open fires. To maintain the fertility of these permanent beds a covering of manure, tobacco stalks, straw, etc., is made as soon as the plants have been removed to the fields. In July and August this decaying vegetable matter furnishes ideal feeding grounds for the grubs or larvæ of the green June beetle. The steaming of the beds the following winter is sufficient to destroy weed seeds but not to kill these grubs, which have burrowed several inches into the soil to pass the winter.

This bulletin gives information on the habits and seasonal history of the grubs of the green June beetle and recommendations for the proper management and treatment of the plant beds.

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THE GREEN JUNE BEETLE[1] LARVA IN TOBACCO PLANT BEDS

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HOW THE PLANT BEDS BECOME INFESTED

THE larvæ, or grubs, of the green June beetle were a serious pest in tobacco plant beds in the vicinity of Clarksville, Tenn., in 1922 and 1923, their presence doubtless being due to changes in cultural methods. Instead of preparing the plant bed in a new place each year, as has been the practice, it is becoming more and more the custom to use the same location year after year and, because of the scarcity of wood and the high wages of labor, to treat the soil with steam instead of burning it with open fires.

After the plants have been removed to the field in the spring, the beds are covered several inches deep with manure, straw, tobacco stalks, or mixtures of these, which remain until late the following fall or winter. This covering is then removed and the beds steamed or burned. It is this second-year bed, covered as described, that attracts the beetles for egg laying. The first-year beds are rarely infested. The young grubs develop rapidly, some becoming full grown by late fall and burrowing deeply into the soil for the winter. Steaming, and even burning, will not reach all the grubs in the deep winter burrows.

The food of the grubs of the green June beetle is decaying vegetable matter on or near the surface of the soil. For the most part the grubs feed on the surface at night and on dark days, resting in their burrows the remainder of the time.

The grubs become very active in the early spring, coming to the surface to feed just at the time the tobacco plants are coming up or are very small. Very little or no injury results directly from the feeding of the grubs on the young plants; but the burrowing and working up of the soil uproots or completely covers the small plants at this stage, and such damage at this time is serious.

SEASONAL HISTORY OF THE GREEN JUNE BEETLE

The adult beetles begin to emerge in June, continue coming out well into July, and disappear about the middle of September. They begin to deposit their eggs a few days after emergence and continue doing so for two or three weeks. The eggs are laid from 3 to 6

[1] *Cotinis nitida* L.; order Coleoptera, family Scarabaeidæ; formerly known as *Allorhina nitida*.

[2] Resigned Feb. 9, 1925.

inches below the surface of the soil and hatch in from 10 to 15 days. The small grubs that come from them work their way up near the surface of the soil and feed on the decaying vegetable matter until late in the fall. A large number by this time have become full grown. As the cold weather approaches they burrow from 8 to 15 inches deep in the ground and remain there in the winter, occasionally coming back near the surface during warm periods to feed. Usually, however, the small quantity of food required in this semidormant period may be found at the depths previously mentioned. Early in the spring the grubs again become very active and work to the surface in search of food. It is this ravenous spring feeding of the grubs a few weeks before they enter the pupal or resting stage that causes the destruction of the small tobacco plants. The grubs make earthen cells from 8 to 10 inches below the surface of the soil, and in these change to pupæ (the resting stage) and about three weeks after forming pupæ change to beetles which find their way to the surface.

NATURE OF DAMAGE

The preferred food of the green June beetle grubs is decaying vegetable matter, although occasionally the small roots of plants are destroyed, probably because of scarcity of the preferred food.

Since most of the decaying vegetable matter is on or near the surface of the soil, it is natural for the grubs to do their feeding there. In badly infested plant beds the surface of the soil becomes rather thoroughly pulverized by the throwing out of the soil or by the miniature molelike burrows made by the grubs in their search for sufficient food to gorge themselves before pupating.

The tobacco plants during this spring activity of the grubs are very small and tender, and a large number may be destroyed by a single grub in a very short time, being either uprooted or completely covered with the loose soil thrown out of the burrow.

Another very serious but indirect damage to grub-infested plant beds is caused by moles and skunks when they are burrowing and digging for the grubs.

HOW TO DETERMINE THE PRESENCE OF THE GRUBS IN THE PLANT BEDS

The presence of the grubs in the plant beds should be determined early enough in the fall so that remedial measures may be taken before the grubs reach the semidormant winter stage. Heavily infested beds should be either treated or abandoned in favor of a new location to insure plants for the following crop.

Certain peculiarities of the green June beetle grub serve to distinguish it from other grubs. These are its miniature, molelike burrows, the pulverizing of the surface soil, and the habit of crawling on its back. If the presence of the grubs is suspected because of molelike burrows and pulverized surface soil, a few of the grubs should be dug out, exposed on a smooth place, and watched for a few minutes. If they crawl upside down or on their backs (see title page) it is certain that they are the grubs of the green June beetle.

If the burrows are very numerous it is best to select an uninfested location for the bed; however, if the use of the present location is much desired the infestation can be greatly reduced as described under "Control measures."

FIG. 1.—Method of broadcasting poisoned-bran bait on tobacco plant beds to control the green June beetle grubs

FIG. 2.—Results obtained from the use of poisoned-bran bait to control the green June beetle grubs in a tobacco plant bed. The area to the right of the stakes was treated; that to the left was not

CONTROL MEASURES

The following discussion of control measures for grubs in tobacco plant beds is based on preliminary experiments conducted under the conditions in which the grubs occurred.

POISONED-BRAN BAIT

A poisoned-bran bait consisting of 1 pound of Paris green to 25 pounds of bran gave excellent control when broadcasted at the rate of from 10 to 12 pounds to each 100 square yards of plant bed (figs. 1 and 2). No counts of live and dead grubs could be made except of those found on the surface, since it was not practicable to dig up the beds. The burrows were thoroughly tramped and each fresh burrow that appeared was scored as a live grub. The relative effectiveness of the bait was then calculated from the number of these burrows.

DUSTING THE PLANT BED

Dusting in the fall with Paris green at the rate of 1 pound to each 100 square yards of plant bed, before the grubs had burrowed too deeply and before the beds had been steamed, gave excellent results.

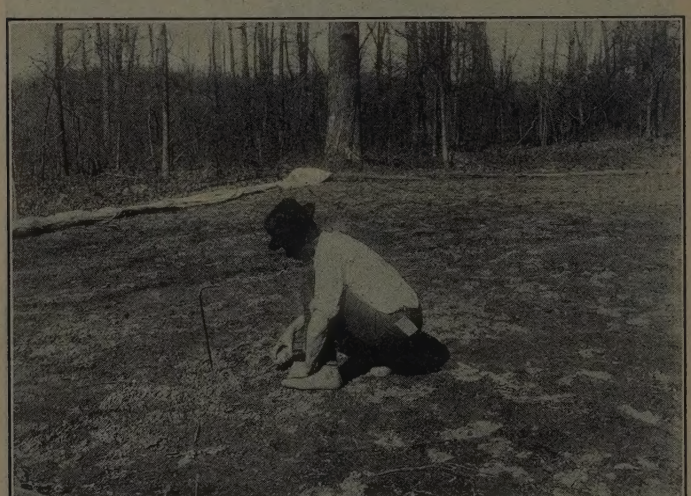

FIG. 3.—Method of applying carbon disulphide with an oil can to a tobacco plant bed to kill the green June beetle grubs

In one experiment 73 per cent of the grubs were killed from eating the poison on the decaying vegetable matter on the surface of the soil.

Arsenate of lead applied in the same manner as the Paris green at the rate of 3 pounds to each 100 square yards of plant bed killed 40 per cent of the grubs.

From these results it would seem that Paris green is the more effective control; if, however, it is not convenient to use Paris green, it may be found that arsenate of lead will give satisfactory results since it remains an active poison longer than Paris green when exposed to the ordinary weather conditions, and the chances of "burning" plants with the poison are much less when arsenate of lead is used.

Following either treatment a second application a week or 10 days after the first is often desirable. If a rain follows immediately after the first application a second will be necessary to get a satisfactory control.

FUMIGANTS

Carbon disulphide when properly applied is very effective but rather expensive. Some excellent controls were obtained by making small holes 8 to 10 inches deep near the burrows of the grubs with a small iron rod, pouring 1 teaspoonful of carbon disulphide into each hole with an ordinary oil can (fig. 3), and then closing the hole with soil. The number of holes or charges depends on the abundance or scarcity of the grubs. Under the usual field conditions the gas will not penetrate the soil very far—probably not more than from 6 to 10 inches.

REPELLENTS

Both nitrobenzene and naphthalene were used in the same manner as described for carbon disulphide, but little or no control could be observed.

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